

2004 Early-Detection Ground Survey for *Phytophthora ramorum* in California

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OBJECTIVES

Sudden Oak Death, caused by the recently described pathogen *Phytophthora ramorum*, is an emerging forest disease that has reached epidemic levels in coastal forests of central and northern California. The disease is now too widespread to broadly apply control methods such as the chemical compounds currently being used to protect high-value, individual trees (Garbelotto et al. 2002). Physical eradication, like that used to remove an isolated cluster of infested forest in southwestern Oregon (Goheen et al. 2002a,b), would also be infeasible for such a large disease area (Rizzo and Garbelotto 2003). For this reason, it is essential to identify pathogen activity at emergent isolated locations, where it may be possible to apply chemical treatments or attempt eradication.

The objective of this work is to target and inspect numerous high-risk locations in order to detect new infections before they become well established and spread further. The data collected will also be used to evaluate and further fine-tune the California risk model of *P. ramorum* establishment and spread (Meentemeyer et al. in press).

EARLY-DETECTION LOCATIONS

At least 300 sites will be systematically inspected for the presence of *P. ramorum* in 24 coastal counties occurring from Del Norte south to San Diego and four counties in the Sierra Nevada foothills (Table 1). For surveying, we have divided the state into two regions based on proximity to known infestations: 1) an Early-Detection Region defined as all areas further than 10 km from a known *P. ramorum* occurrence and 2) a Region of Infestation (ROI) defined as areas within 10 km of *P. ramorum* occurrences (Figure 1). For both regions, survey locations will take place only in public lands (e.g. national forest and state parks) to avoid substantial costs associated with obtaining permission to access private property.

Early-Detection Region. 200 randomly generated survey locations have been targeted for early-detection survey in Very High and High-risk habitats (half very high, half high). A 200 m buffer has been created along all types of roads in public lands to ensure that the survey locations are accessible. A pool of 50 of secondary locations has also been created, which will be used if primary locations are inaccessible or habitat is incorrectly mapped.

Region of Infestation. For the infested region, we are surveying 100 randomly generated locations, which are evenly distributed across all risk levels (low, moderate, high). Here, survey locations are not constrained by distance to roads like in the Early-Detection Region. A pool of 50 secondary locations is created for this region as well, which can be used if one of the primary locations is inaccessible or habitat is incorrectly mapped.

DATA COLLECTION

Early-Detection Region. Data collected here will follow the new protocol for the 2004 National *Phytophthora ramorum* Survey of Forest Environments. The system is based on two 200 m transects that intersect each other at right angles (Figure 2). One transect runs in the upslope direction from plot center, the other 90 degrees clockwise from the center across the slope. This is not an area-based survey; transect width is simply based on how far you can see, which is dependent upon vegetation density and terrain. Along each transect, leaf samples will be collected from all host species that show potential disease symptoms of *P. ramorum*. After collection, up to five of the most symptomatic leaves from no more than five individuals will be stored for lab confirmation. Woody tissue samples from the trunk of oaks will be collected only if foliar hosts are not present. Foliar and trunk samples will be sealed in plastic bags in the field, stored in coolers in cars, and promptly sent via overnight mail to Cheryl Blomquist (CDFA) for pathogen identification in infested counties and to David Rizzo's Lab (UC Davis) in uninfested counties. Mailed samples that cannot arrive at a lab by a Friday morning, will be kept refrigerated and mailed on Monday.

At each site, we are also visually estimating the relative percent cover of host species present and using a Cruz-All ocular gauge to measure basal area of the forest stand from plot center. Transects that traverse non-host habitat (e.g. grassland, chaparral, barren) or cross a physically inaccessible area may be truncated.

Region of Infestation. Data collected within the Region of Infestation will follow the methods used in the 2003 early-detection survey in California. At each site, two transects (30 m x 10 m) will be established running perpendicular to each other from the plot center (Figure 3). The first transect runs in the upslope direction from plot center and the other runs 90 degrees clockwise from the center across the slope. Symptomatic host material and vegetation composition data will be collected and processed in the same fashion as in the Early-Detection Region.

Table 1. Twenty-eight survey counties.

| | |
|--------------|-----------------|
| Alameda | Riverside |
| Butte | San Bernardino |
| Contra Costa | San Diego |
| Del Norte | San Luis Obispo |
| Humboldt | San Mateo |
| Lake | Santa Barbara |
| Los Angeles | Santa Clara |
| Marin | Santa Cruz |
| Mendocino | Siskiyou |
| Monterey | Solano |
| Napa | Sonoma |
| Nevada | Trinity |
| Orange | Ventura |
| Placer | Yuba |

Figure 1. Regions of Infestation and Early Detection in California. Points are locations of *Phytophthora ramorum* presence. The shaded area is the Region of Infestation defined to be within 10 km of *P. ramorum* occurrences. Areas not shaded are further than 10 km from a *P. ramorum* site and are targeted for Early-Detection surveys.

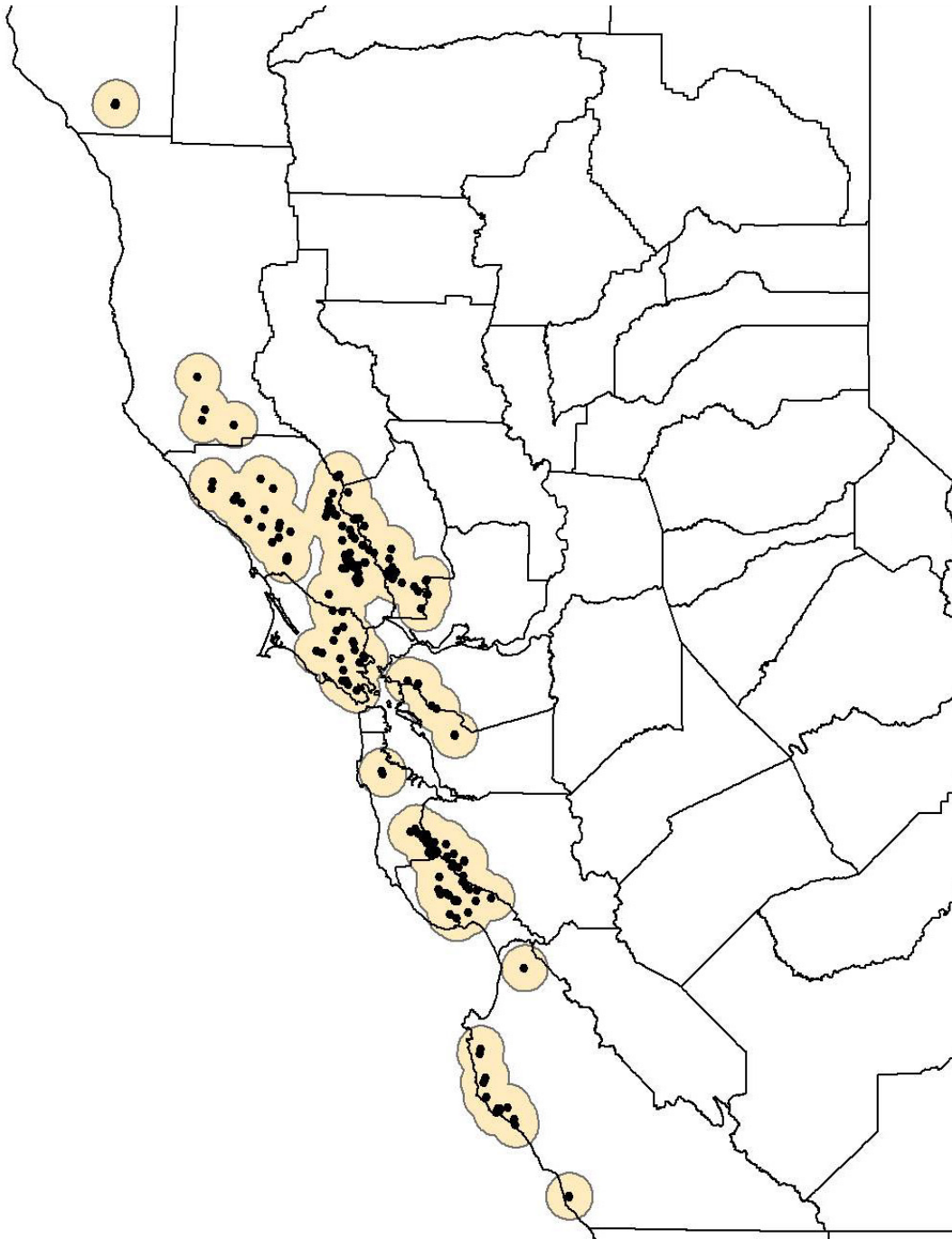


Figure 2

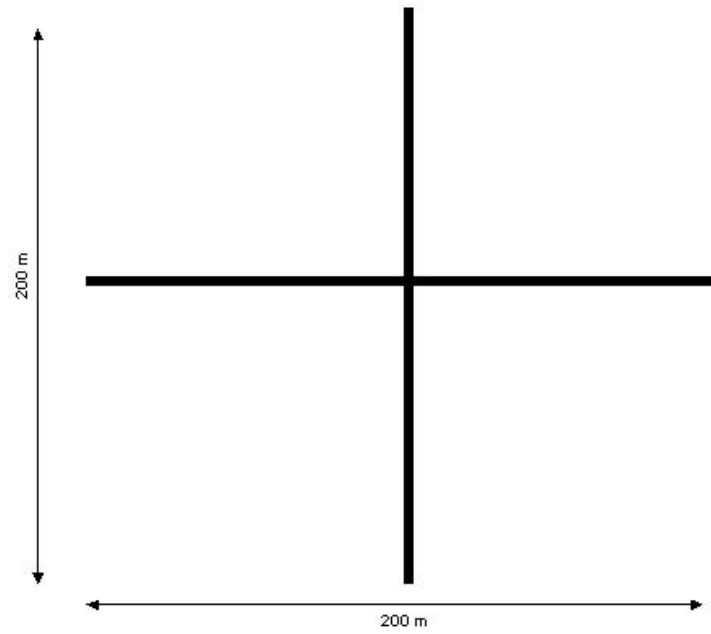


Figure 3

